

*Idaho National Engineering and Environmental Laboratory*

# ***RELAP5 Input Builder GUIs THUMB & PYGMALION***

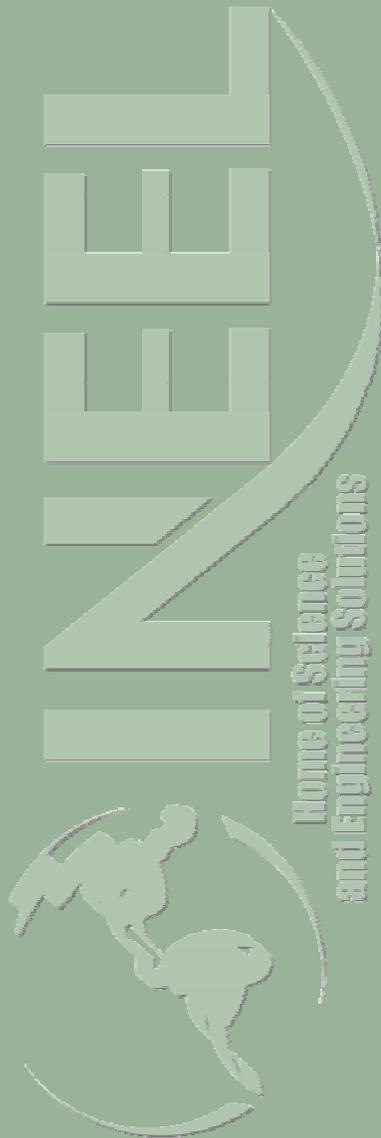
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Dr. George L. Mesina*

*2002 RELAP5 International RELAP5  
Users Seminar*

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# Outline

- *GUI Background*
- *THUMB Design & Purpose*
- *THUMB Status*
- *THUMB Future Developments*
- *PYGMALION GUI*

# ***GUI Background Information***

- *Widely used*
  - *Few applications remain without one*
- *Many benefits*
  - *Organizes work, clarifies requirements, gives help, prevents omissions and incorrect input*
  - *Conveys information by multiple visual means*
- *Good GUI construction tools available, for example*
  - *JAVA Language*
  - *J-Builder*

# ***RELAP5-Related Input GUIs***

- *Older GUIs*
  - *ATHENA Aid*
  - *TROPIC*
- *Engineering Code Pre-Processor (ECPP)*
  - *For RETRAN only*
  - *Uses Microsoft Foundation Classes*
- *SNAP for RELAP5/Mod3.2*
  - *No 3D input*
  - *No input for special RELAP5-3D capabilities*

# ***THUMB Purpose***

- *Provide model builder for RELAP5-3D*
  - *3D input, special RELAP5-3D model input*
- *Visual means of model construction*
- *Reduce input file construction time*
- *Convenience: reduce user need to memorize card formats*
- *Information: hyperlinks to manuals*
- *Prevention: reduce card format errors and omissions*

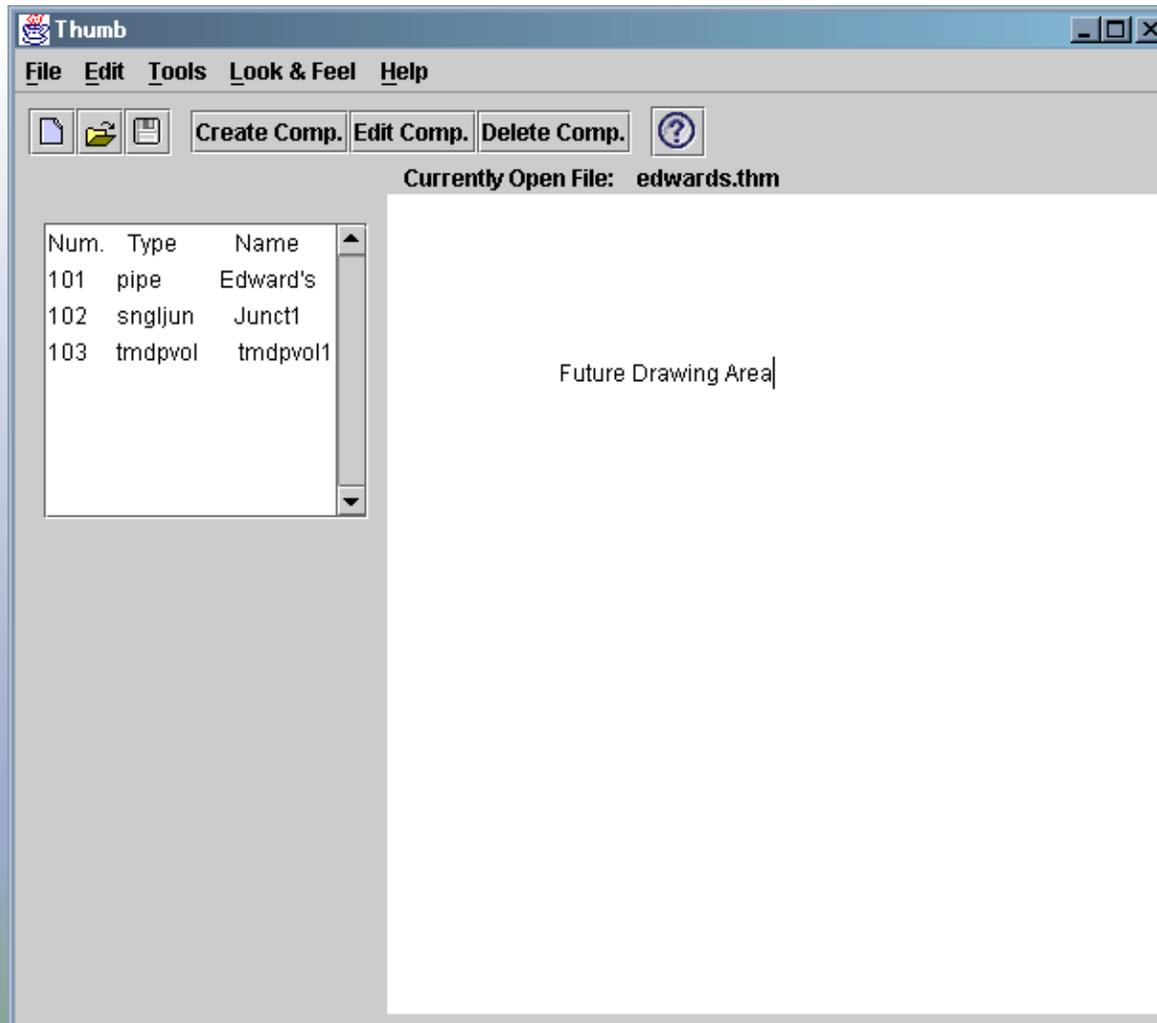
# ***THUMB Design Issues***

- *Platform independent (via JAVA)*
- *Native look and feel (JAVA)*
- *Drag and drop input model construction*
- *Data entry via menu/dialog*
- *Object-oriented programming*
  - *Faster, more efficient development*
  - *Reduced maintenance cost*

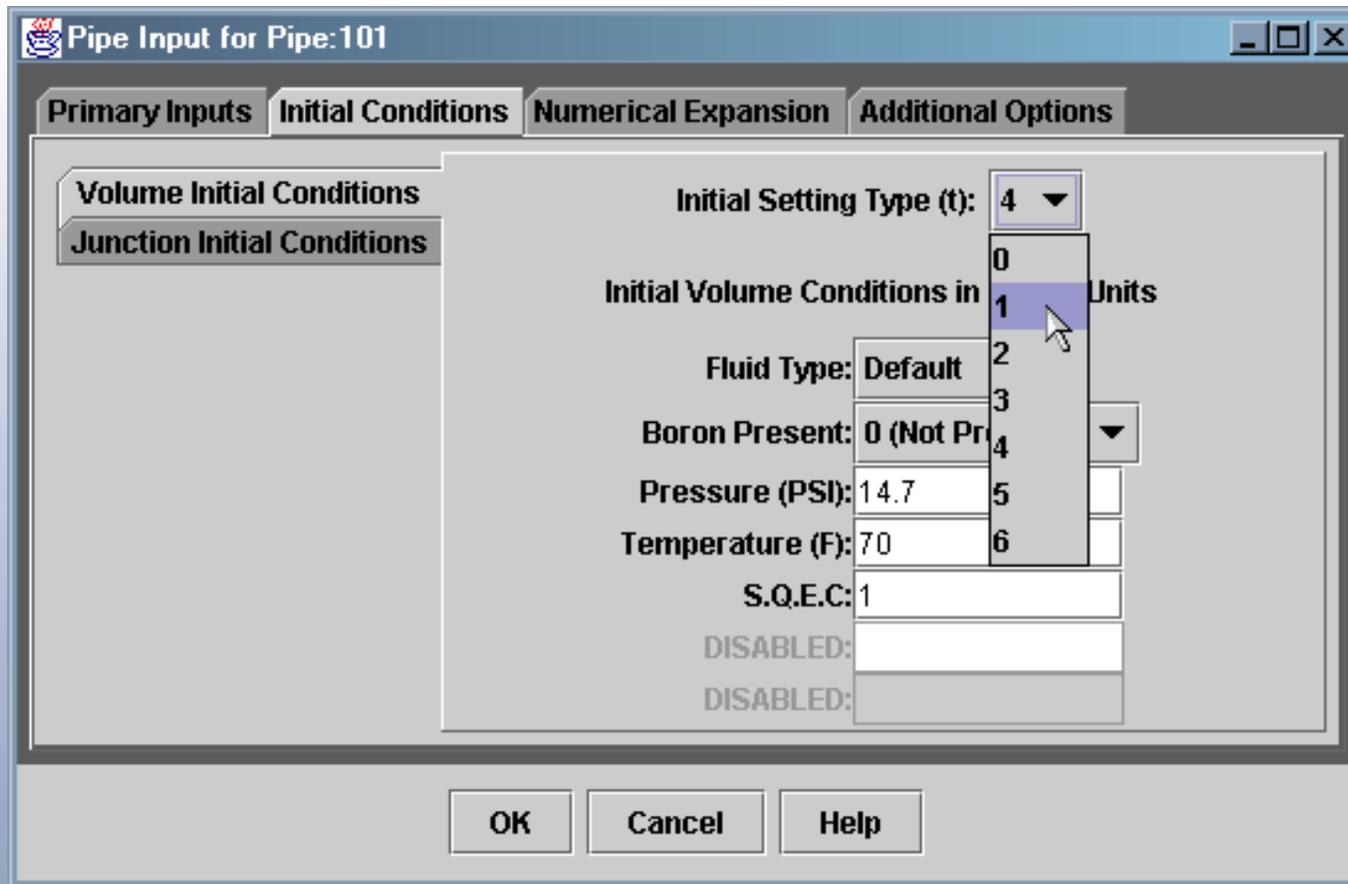
# ***THUMB Prototype Is Partially Built***

- *Three TH components are fully functional*
  - *Pipe, single junction, time dependent volume*
  - *Not complete (e.g. no sequential expansion)*
- *Data handling by entry widgets*
  - *Lists all data*
  - *Flags required data*
  - *Catches illegal or omitted values.*
- *Saves and reopens model builder sessions*
- *Constructs viable RELAP5-3D input files*

# THUMB Main Level Screen



# THUMB Pipe Component Screen

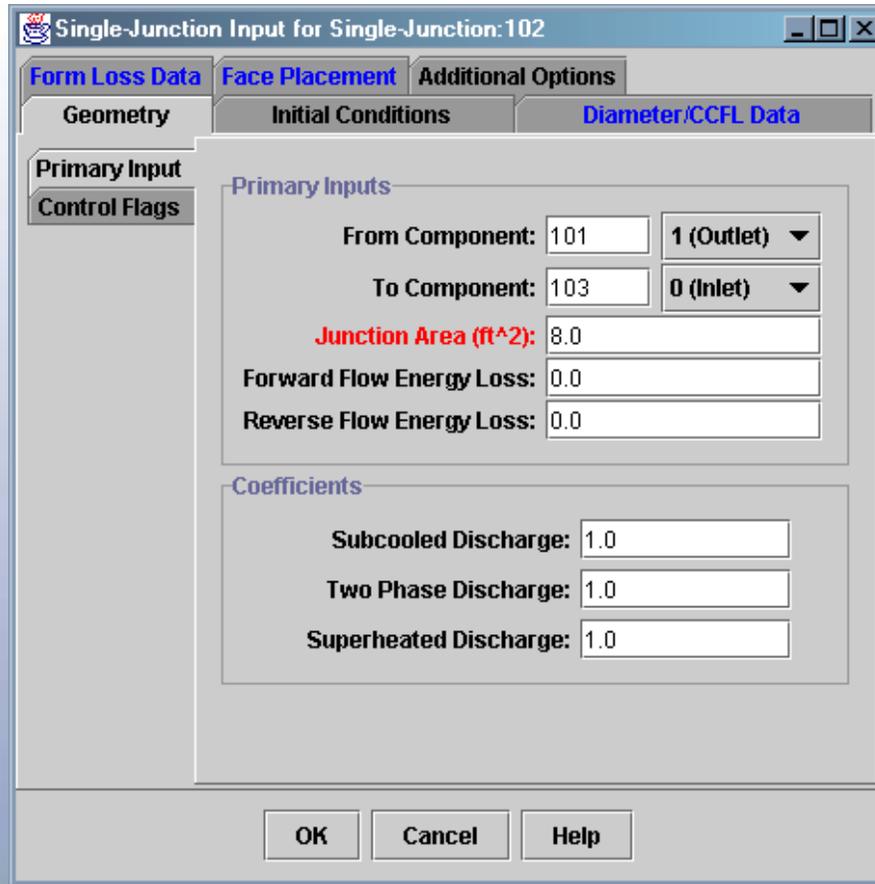


The screenshot shows a software window titled "Pipe Input for Pipe:101" with four tabs: "Primary Inputs", "Initial Conditions", "Numerical Expansion", and "Additional Options". The "Initial Conditions" tab is active. On the left, there are two sub-tabs: "Volume Initial Conditions" and "Junction Initial Conditions". The main area contains the following fields:

- Initial Setting Type (t): 4 (dropdown menu)
- Initial Volume Conditions in: 1 Units (dropdown menu)
- Fluid Type: Default
- Boron Present: 0 (Not Present) (dropdown menu)
- Pressure (PSI): 14.7
- Temperature (F): 70
- S.Q.E.C.: 1
- DISABLED: (disabled field)
- DISABLED: (disabled field)

At the bottom, there are three buttons: "OK", "Cancel", and "Help".

# THUMB Single Junction Screen



The screenshot shows a software dialog box titled "Single-Junction Input for Single-Junction:102". It features several tabs: "Form Loss Data", "Face Placement", "Additional Options", "Geometry", "Initial Conditions", and "Diameter/CCFL Data". The "Primary Input" and "Control Flags" sections are visible on the left. The main area contains two sections: "Primary Inputs" and "Coefficients".

**Primary Inputs**

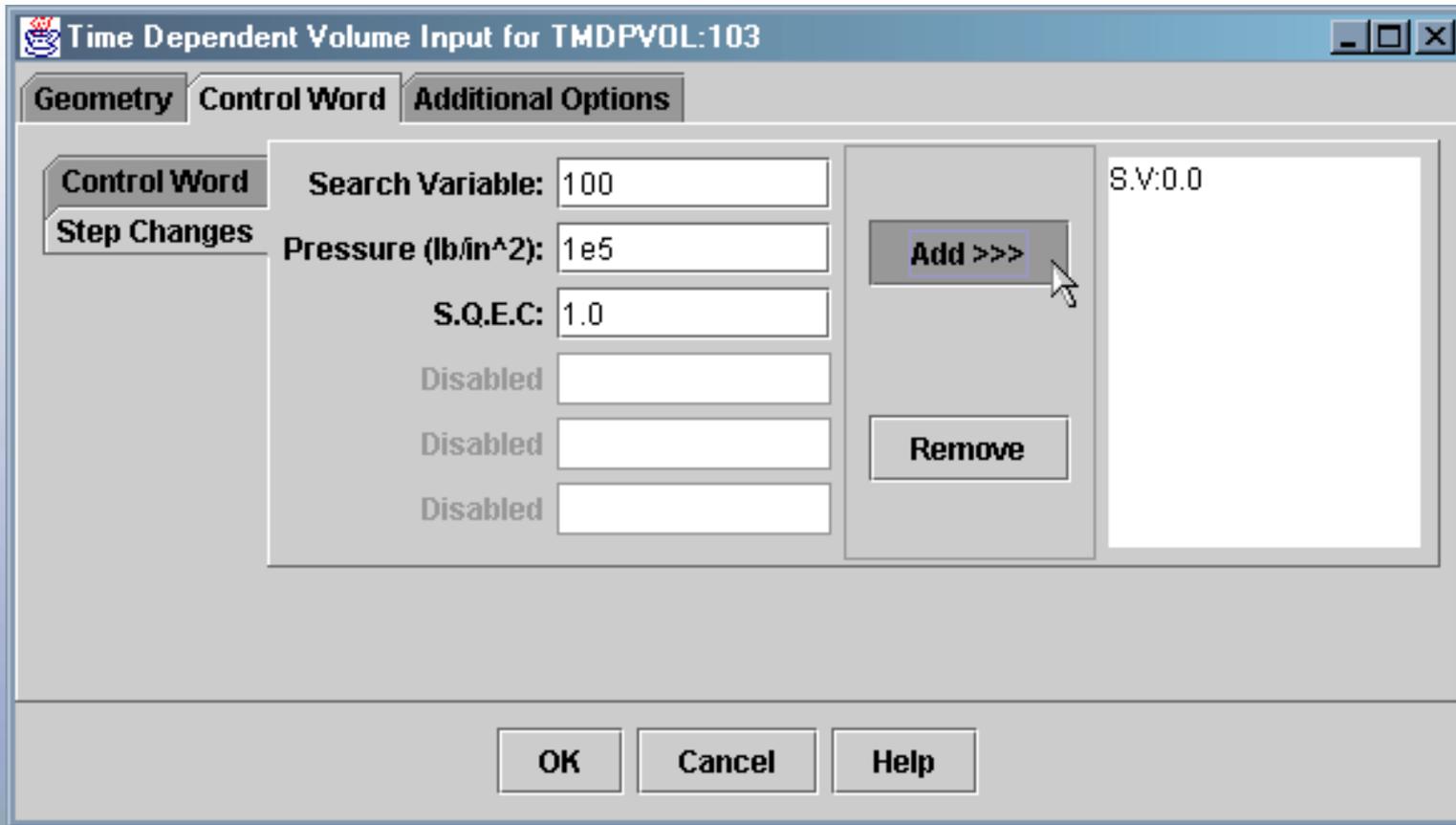
From Component:	101	1 (Outlet) ▼
To Component:	103	0 (Inlet) ▼
Junction Area (ft <sup>2</sup> ):	8.0	
Forward Flow Energy Loss:	0.0	
Reverse Flow Energy Loss:	0.0	

**Coefficients**

Subcooled Discharge:	1.0
Two Phase Discharge:	1.0
Superheated Discharge:	1.0

Buttons: OK, Cancel, Help

# THUMB Time Dependent Volume Screen



Time Dependent Volume Input for TMDPVOL:103

Geometry Control Word Additional Options

Control Word Step Changes

Search Variable: 100

Pressure (lb/in<sup>2</sup>): 1e5

S.Q.E.C: 1.0

Disabled

Disabled

Disabled

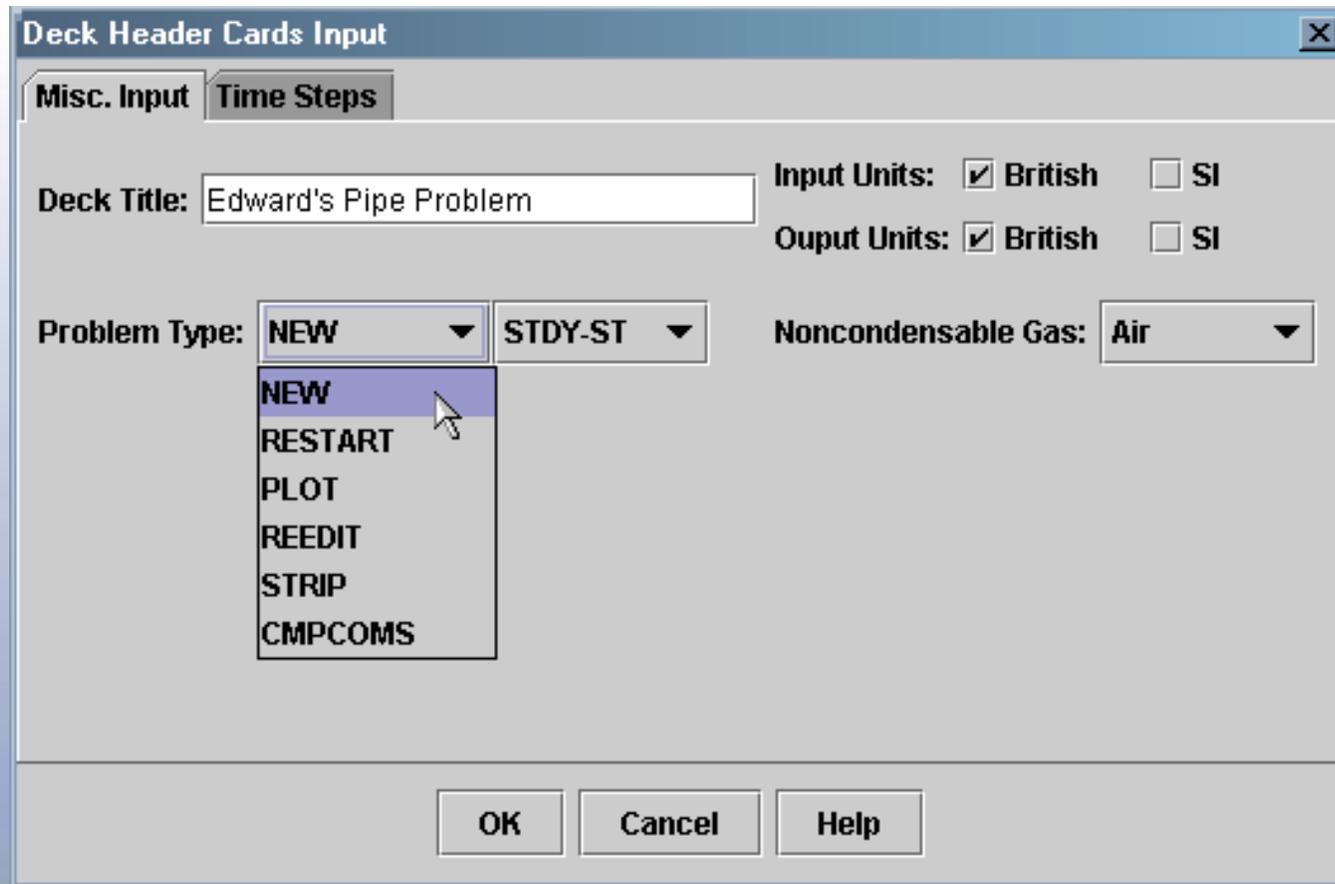
Add >>>

Remove

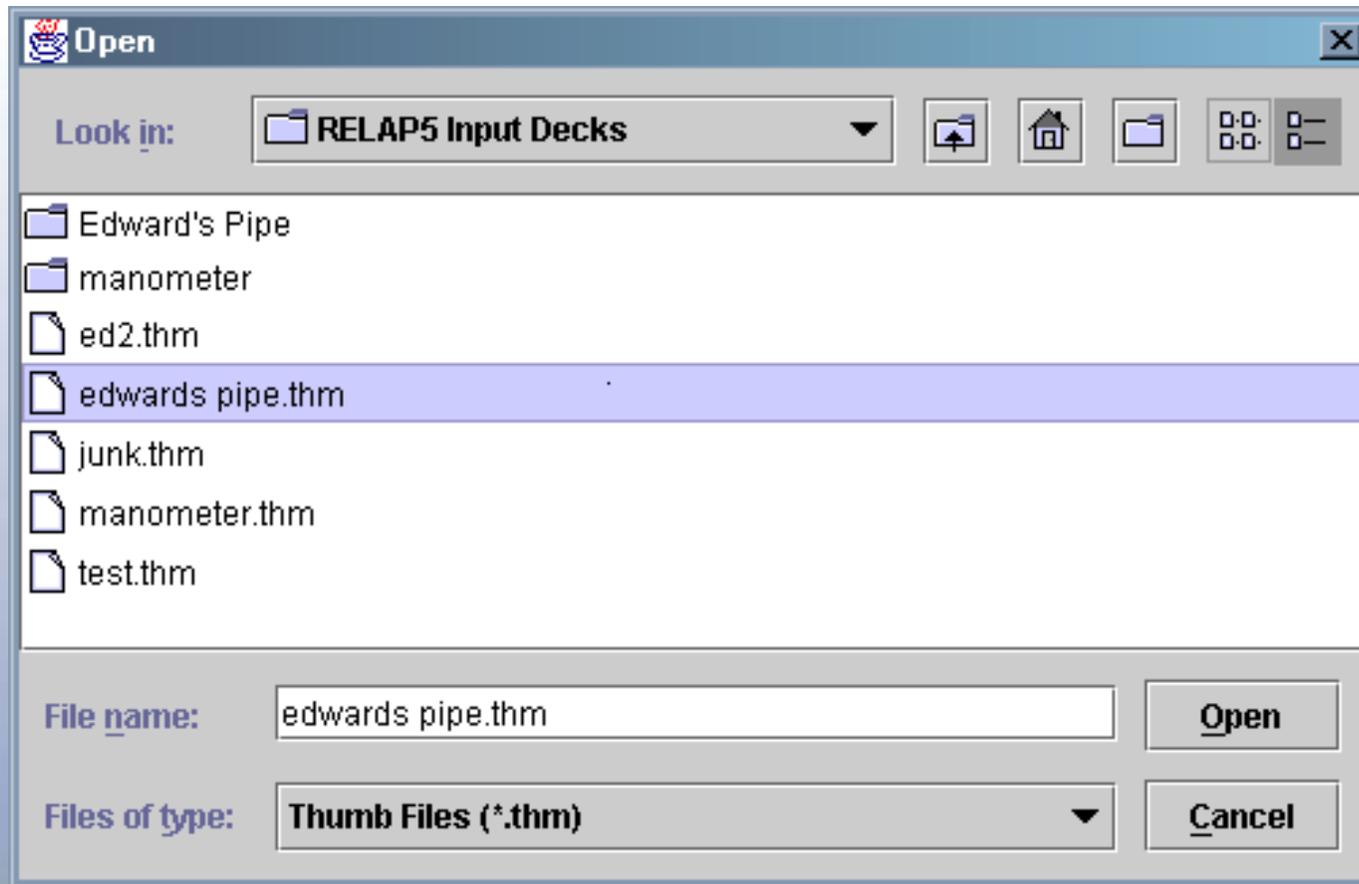
S.V:0.0

OK Cancel Help

# Miscellaneous Screens



# Miscellaneous Slides



# THUMB-created Input File for Edwards-O'Brien Blowdown

```
=edwards pipe problem
*
0000100      new transnt      * Problem Type *?
0000102      si si           * input units, output units * ?
*0000110      air           * Noncondensable Gas * ?
*0000115      1.0           * Mass Fraction * ?
*
* Time Step Data *?
0000201      0.02 1.0E-7 0.0010    007 2 10 100
0000202      0.1 1.0E-7 0.0010    007 10 20 100
0000203      0.5 1.0E-7 0.0010    007 10 50 100
*
*
*-----1-----1-----1-----1-----1-----1-----1-----
* Pipe Number: 3 Pipe Name: edwards
*-----1-----1-----1-----1-----1-----1-----1-----
* Description: none
*-----1-----1-----1-----1-----1-----1-----1-----
*
*           W1           W2           W3           *?
30000      "edwards" pipe
30001      20           * Number of Cells *?
30101      0.00456037 20      * Pipe Flow Area *?
*30201      0.0           19      * Pipe Junction Flow Area *?
30301      0.204801 20      * Pipe Volume Length *?
```

# Input File (Continued)

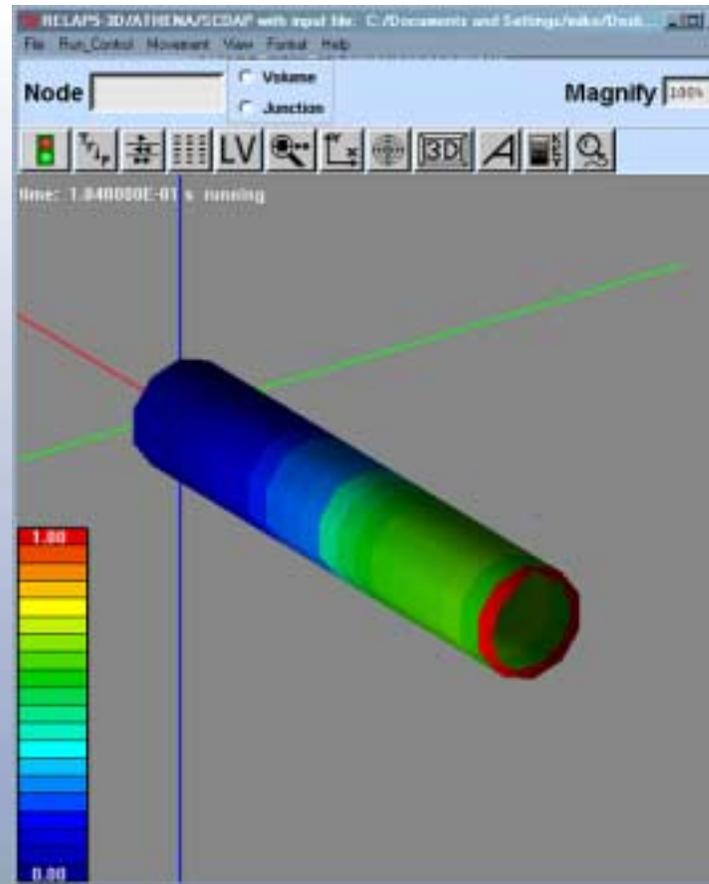
```

30401      0.0      20      * Pipe Volume Volumes *?
*30501      0.0      20      * Pipe Volume Azimuthal Angle *?
30601      0.0      20      * Volume Inclination Angle *?
*30701      0.0      20      * Volume Elevation Change *?
30801      1.177911E-6 0.0 20      * wall roughness & hy dia *?
*30901      0.0      0.0  19      * FFEL Coefficient, RFEL Coefficient *?
31001      0000000  20      * Pipe Control Flags *?
31101      00000000  19      * Junction Control Flags *?
31201      000 7000000.0 978293.0 2581840.0 0.0 0.0 20 * Initial Conditions *?
31300      0      * Junct. Init. Control Word *
31301      0.0      0.0  0.0  19      * Junct. Init. Conditions *
*-----1-----1-----1-----1-----1-----1-----1-----
*  Single Junction Number: 4  Single Junction Name: rhtbdy
*-----1-----1-----1-----1-----1-----1-----1-----
*  Description: none
*-----1-----1-----1-----1-----1-----1-----1-----
*
      W1  W2  W3  *?
40000      "rhtbdy"  sngljun
40101      3010000 5000000 0.00396751 0.0 0.0 00000000 1.0 1.0 1.0
*40110      0.0 0.0 1.0 1.0      * Single-Junction Diameter and CCFL Data *?
*40111      0.0 0.0 0.0 0.0      * SingJunct Form Loss Data *?
*40113      0.0 0.0 0.0 0.0      * SingJun Face Placement *?
40201      0 0.0 0.0 0.0      * Initial Conditions *?
    
```

# *Input File (Continued)*

```
*-----1-----1-----1-----1-----1-----1-----1-----1-----
*   Time Dependent Volume Number: 5   Time Dependent Volume Name: none
*-----1-----1-----1-----1-----1-----1-----1-----1-----
*   Description: none
*-----1-----1-----1-----1-----1-----1-----1-----1-----
*
*           W1           W2      W3   *?
50000      "none"      tmdpvol
50101      0.00456037 0.204801 0.0 0.0 0.0 0.0 1.177977E-6 0.0 0
50200      002                               * tmdpvol Data Control Word *
50201      0.0 100000.0 1.0   100.0 100000.0 1.0   * Search Variable *
*
.end
```

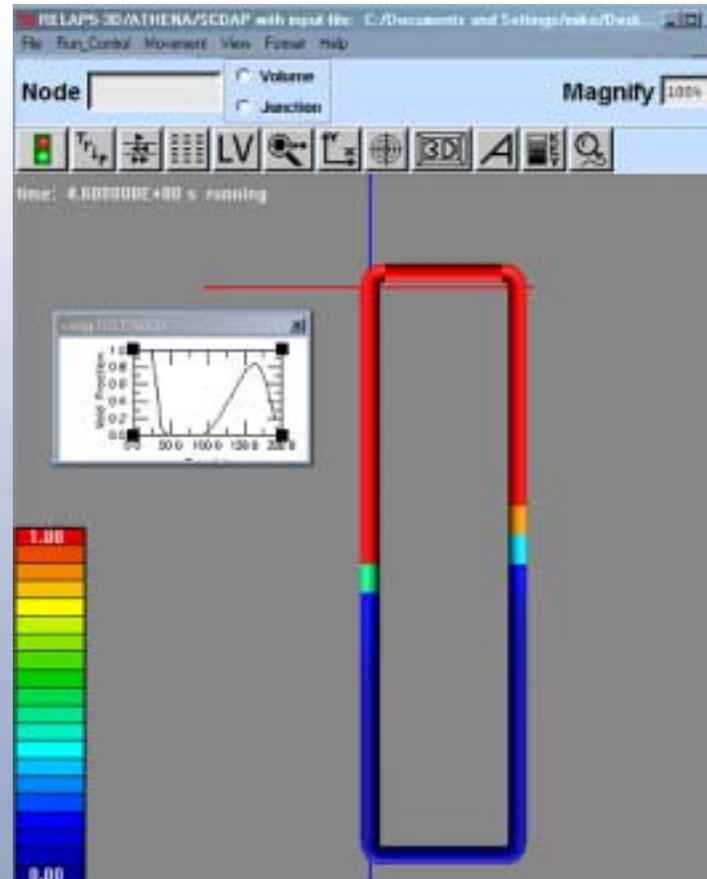
# ***THUMB Edwards Pipe Model Shown by RGUI***



# ***Manometer Problem***

- *Two vertical lengths of pipe connected by horizontal pipes at top and bottom*
- *Workaround (no sequential expansion)*
  - *Vertical pipes are modeled as 2 pipes each*
  - *Each upper pipe is initialized to all gas*
  - *Each lower pipe is initialized to all liquid*
- *Use of horizontal pipes for aesthetics only*
  - *Original RELAP5 model uses SJs instead*
  - *Then RGUI does not separate the vertical pipes*

# ***THUMB Manometer Shown by RGUI***



# ***THUMB Future Developments***

- *Finish major hydrodynamic components*
  - *SV, TDJ, branch, valves*
- *Complete input capabilities of all components (e.g. sequential expansion)*
- *Add drag & drop model-construction feature*
- *Rewrite prototype as working product*

# ***PYGMALION***

## ***Steady-state Input File Builder***

- *Input to PYGI*
  - *RELAP5 input file and its restart-plot file*
  - *Command-line input directives*
- *Output*
  - *New RELAP5 input file with*
    - *Final hydro conditions as initial conditions*
    - *Final values of control variable as initial values*
  - *Screen summary (on “standard error”)*
    - *Information about the transcription process*

# PYGMALION GUI Screen

Pygmalion Run Choices

**PYGMALION Run Choices**

**File** **S**elect **R**eset **H**elp

**Run** **Cancel**

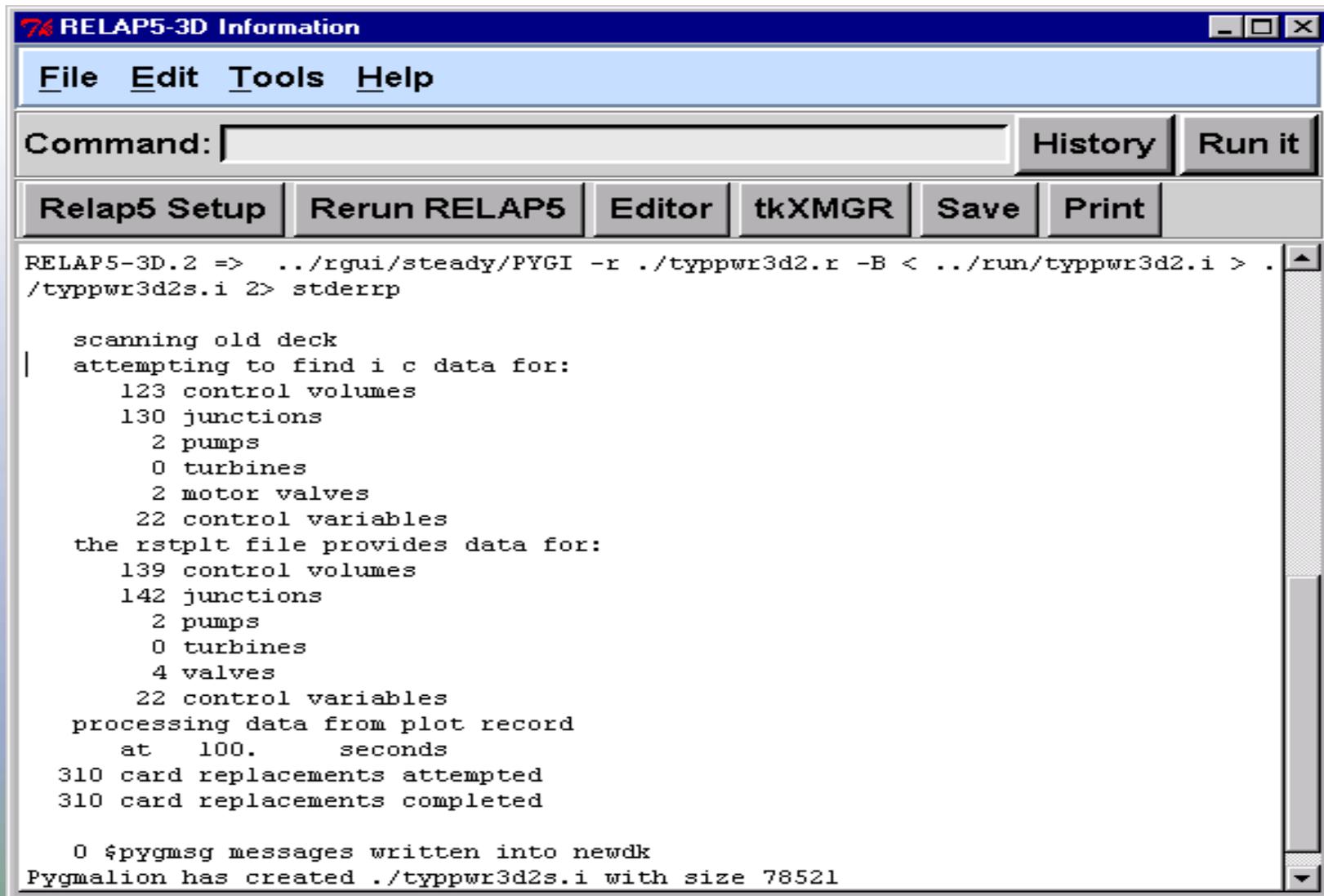
<b>PYGMALION executable</b>	../rgui/steady	PYGI
<b>Input file</b>	../run	typpwr3d2.i
<b>Output file</b>	.	typpwr3d2s.i
<b>-r Restart-plot file</b>	.	typpwr3d2.r
<b>-t time</b>		
<b>-e normalized truncation</b>		

- B**      Forces PYGI to examine records that start with a blank
- C**      Inhibits PYGI from changing control variable initial condntions
- I**      Indicates that the input file is a RELAP5/MOD1 input deck
- O**      Forces PYGI to create a RELAP5/MOD1 input deck as output

# ***PYGMALION GUI*** ***Available through RGUI 3D-Station***

- *Looks much like RELAP5 Run Settings Screen*
- *User selects PYGMALION files and directives*
  - *Input file, restart file, new input file*
    - *Find, browse, auto-rename features*
  - *Can save and reopen sets of selections*
  - *On-line help*
- *Summary of PYGMALION goes on 3D-Station*
- *Size of new input file is reported there also*

# PYGMALION Output on 3D-Station

A screenshot of a Windows-style application window titled 'RELAP5-3D Information'. The window has a menu bar with 'File', 'Edit', 'Tools', and 'Help'. Below the menu bar is a 'Command:' input field, a 'History' button, and a 'Run it' button. A row of buttons includes 'Relap5 Setup', 'Rerun RELAP5', 'Editor', 'tkXMGR', 'Save', and 'Print'. The main area contains a terminal window with the following text:

```
RELAP5-3D.2 => ../rgui/steady/PYGI -r ./typpwr3d2.r -B < ../run/typpwr3d2.i > .  
/typpwr3d2s.i 2> stderrp  
  
scanning old deck  
attempting to find i c data for:  
  123 control volumes  
  130 junctions  
   2 pumps  
   0 turbines  
   2 motor valves  
  22 control variables  
the rstplt file provides data for:  
  139 control volumes  
  142 junctions  
   2 pumps  
   0 turbines  
   4 valves  
  22 control variables  
processing data from plot record  
  at 100. seconds  
310 card replacements attempted  
310 card replacements completed  
  
0 $pygmsg messages written into newdk  
Pygmalion has created ./typpwr3d2s.i with size 78521
```

# Summary

- *There are two input model builder GUIs*
- *THUMB helps user build RELAP5 input files*
- *Three TH components are now available in THUMB*
- *THUMB prototype produces correct input decks*
- *PYGMALION has been equipped with a GUI*